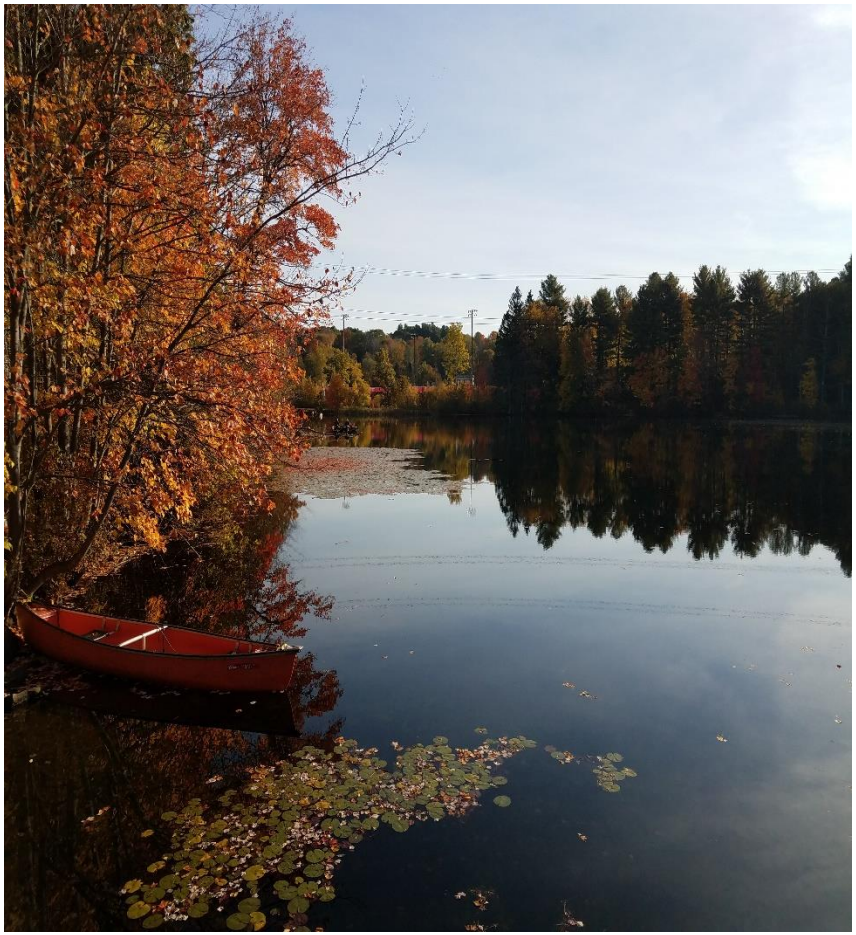
welcome

transform your environment

LAKE ELLIS WATERSHED SURVEY

LAKE ELLIS WATERSHED SURVEY



ATHOL
MASSACHUSETTS

EPA/DEP FUNDED
604b GRANT

2020/2021

LAKE ELLIS LOCUS
ATHOL, MASSACHUSETTS

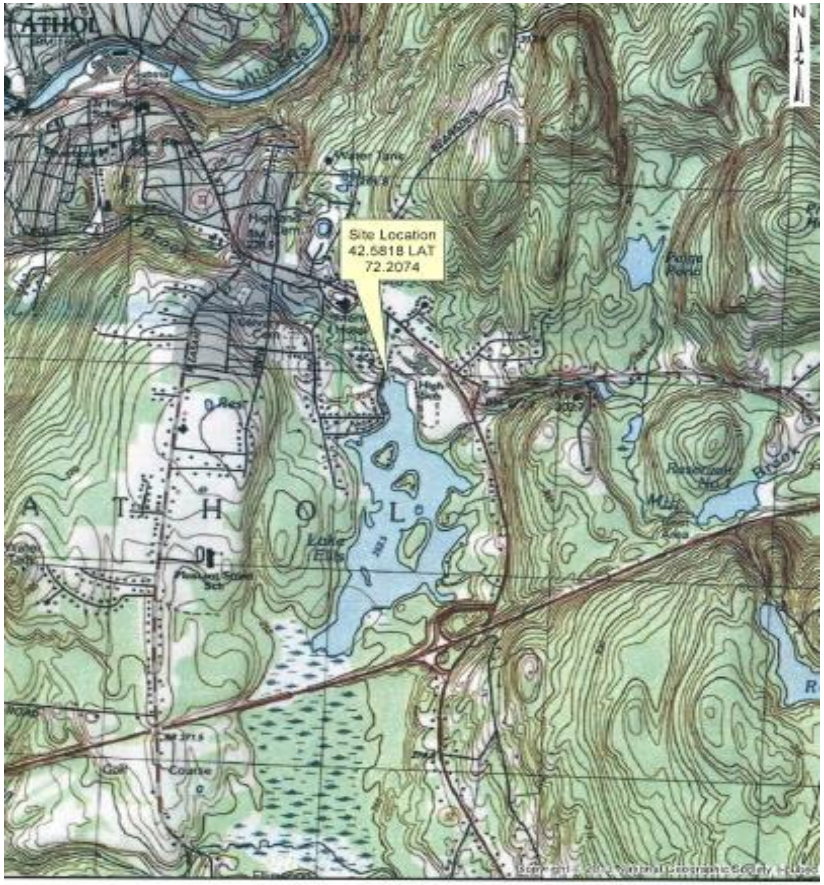


FIGURE 1
Lake Ellis
Athol, Massachusetts

Locus Map

1,000 0 1,000
Scale in Feet

Weston & Sampson

Lake Ellis Watershed Survey

- Project Administrator – Eric Smith, Director, Athol Department of Planning & Community Development
- Consultant Project Manager – Joe McGinn, Senior Project Manager, Weston & Sampson
- QAPP/Evaluations of Alternative Control Measures – Sam Bade, PE, SSV Engineering, Certified MBE
- Community Involvement/Coordination – Katherine Robertson, Certified WBE
- The Athol/Lake Ellis Community and Stakeholders

Lake Ellis Watershed Survey

Purposes:

- Update the Characterization of the Lake Ellis Watershed
  - Confirm the Watershed Boundary Delineation
  - Update Land Use within the Drainage Area
- Assess Current Water Quality Conditions
- Confirm and Assess Water Quality Impairments
  - Aquatic Weeds
  - Phosphorus levels
  - Other Issues
- Evaluate Measures to Reduce/Eliminate Impairments and Achieve Use Objectives for Lake Ellis

LAKE ELLIS WATERSHED SURVEY SAMPLING PLAN

SAMPLING STATION LOCATIONS

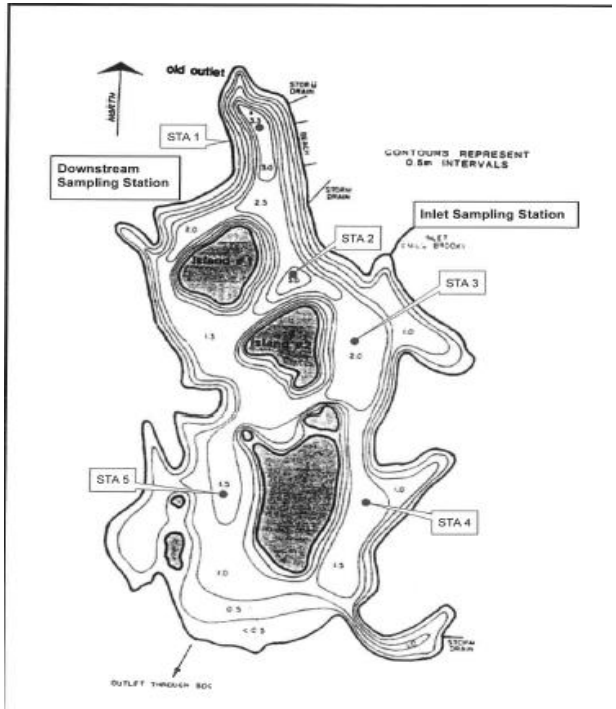


FIGURE 2
Lake Ellis Sampling Plan
Athol, Massachusetts

Weston & Sampson

Base Bathymetry Provided by

WATER QUALITY SURVEY PARAMETERS

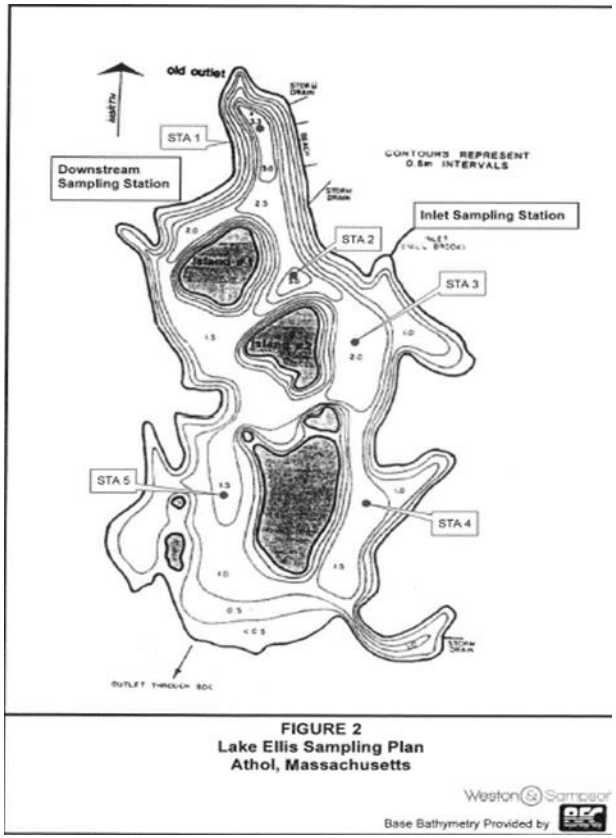
- SECCHI DEPTH
- TEMPERATURE
- pH
- CONDUCTIVITY
- DISSOLVED OXYGEN

- TOTAL PHOSPHORUS
- ORTHOPHOSPHORUS
- TOTAL SUSPENDED SOLIDS
- TOTAL DISSOLVED SOLIDS
- CHLOROPHYLL a

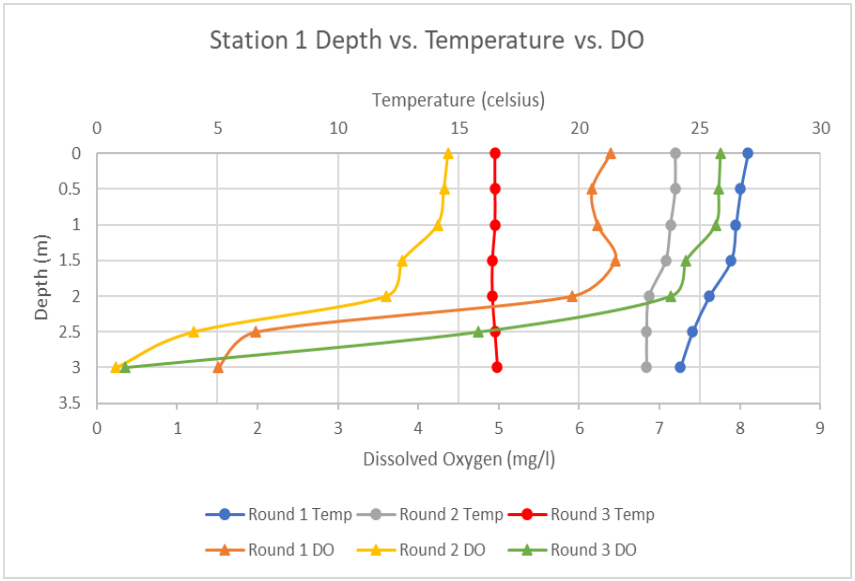
- FECAL COLIFORM
- E. COLI.

Lake Ellis Watershed Survey
Water Quality Sampling Results

SAMPLING STATION LOCATIONS



Sampling Results
Station 1 – Depth vs Temperature & DO



Round 1 – July 23, 2020
Round 2 – August 26, 2020
Round 3 – October 7, 2020

Lake Ellis Watershed Survey
Water Quality Sampling Results

SAMPLING STATION LOCATIONS

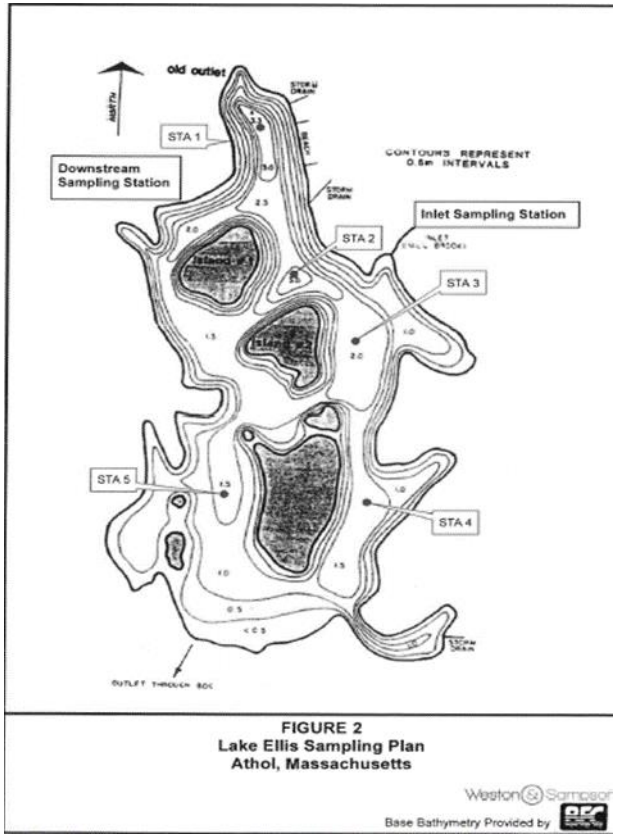
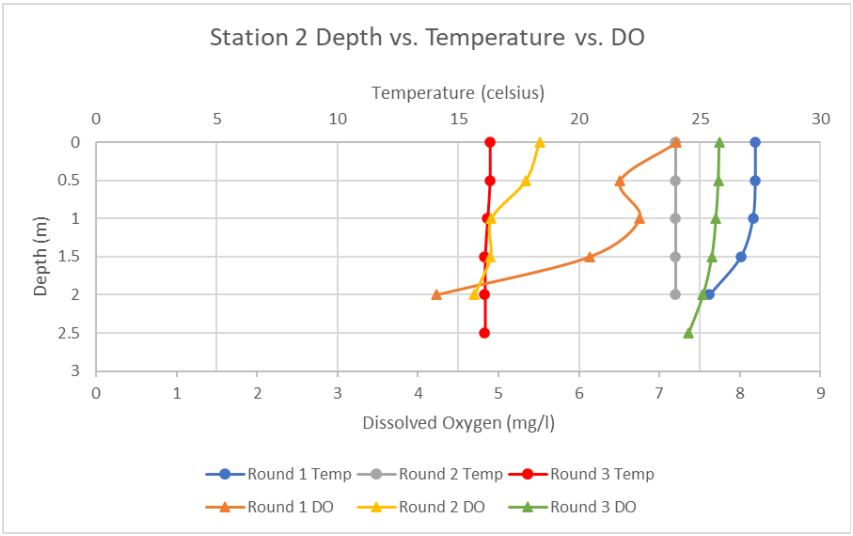


FIGURE 2
Lake Ellis Sampling Plan
Athol, Massachusetts

Base Bathymetry Provided by

Sampling Results
Station 2 – Depth vs Temperature & DO



Lake Ellis Watershed Survey
Water Quality Sampling Results

SAMPLING STATION LOCATIONS

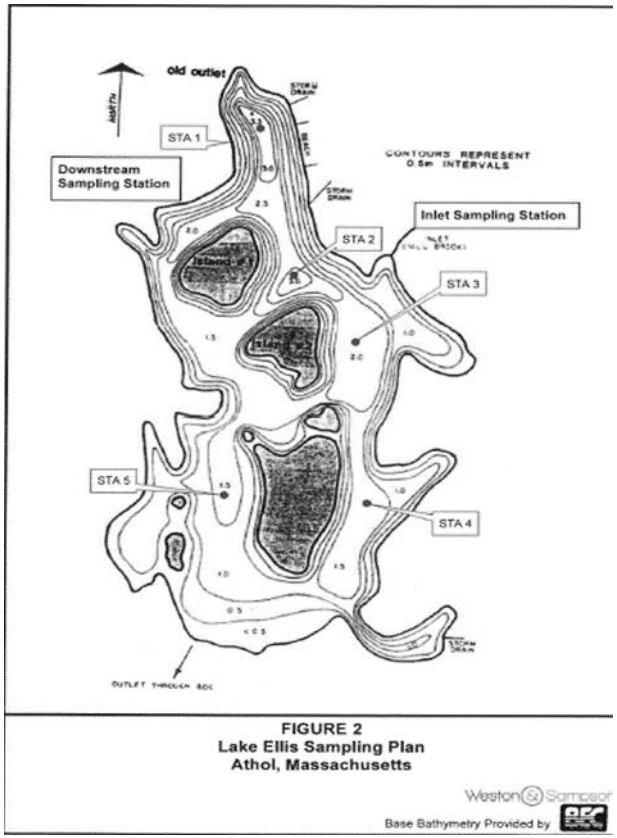
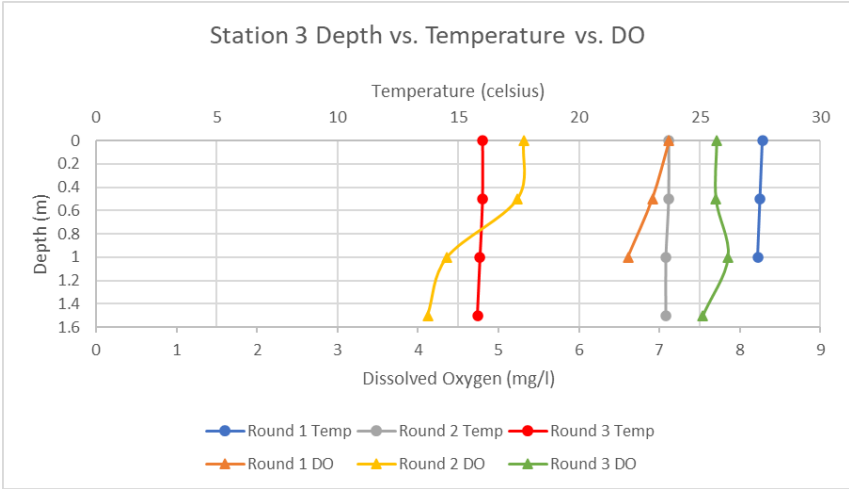


FIGURE 2
Lake Ellis Sampling Plan
Athol, Massachusetts

Weston & Sampson

Base Bathymetry Provided by

Sampling Results
Station 3 – Depth vs Temperature & DO



Lake Ellis Watershed Survey
Water Quality Sampling Results

Sampling Results

SAMPLING STATION LOCATIONS

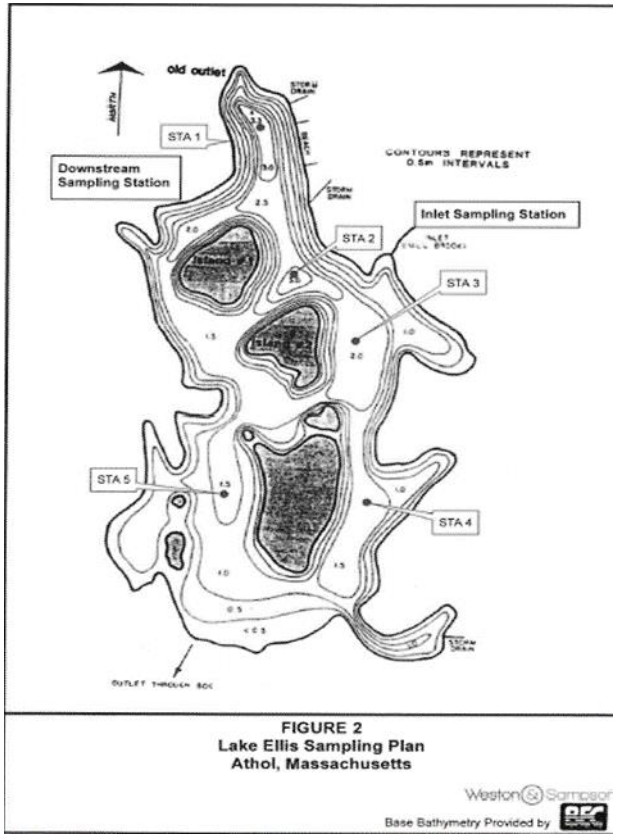
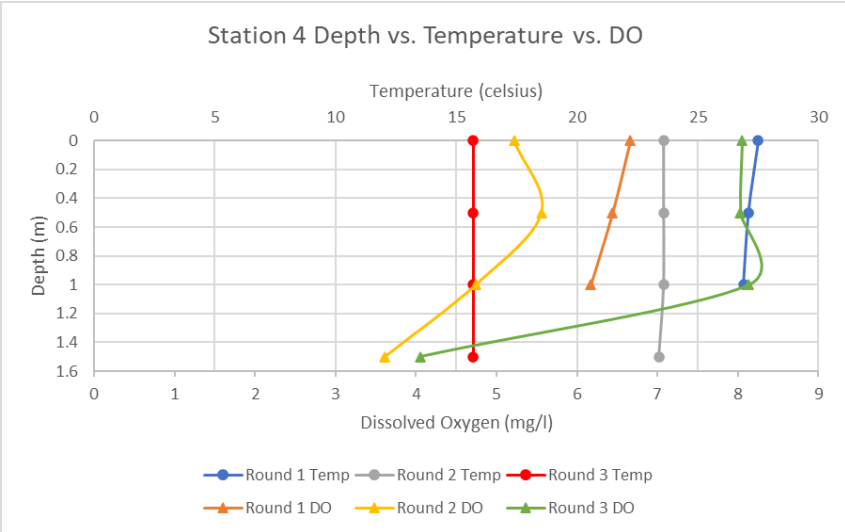


FIGURE 2
Lake Ellis Sampling Plan
Athol, Massachusetts

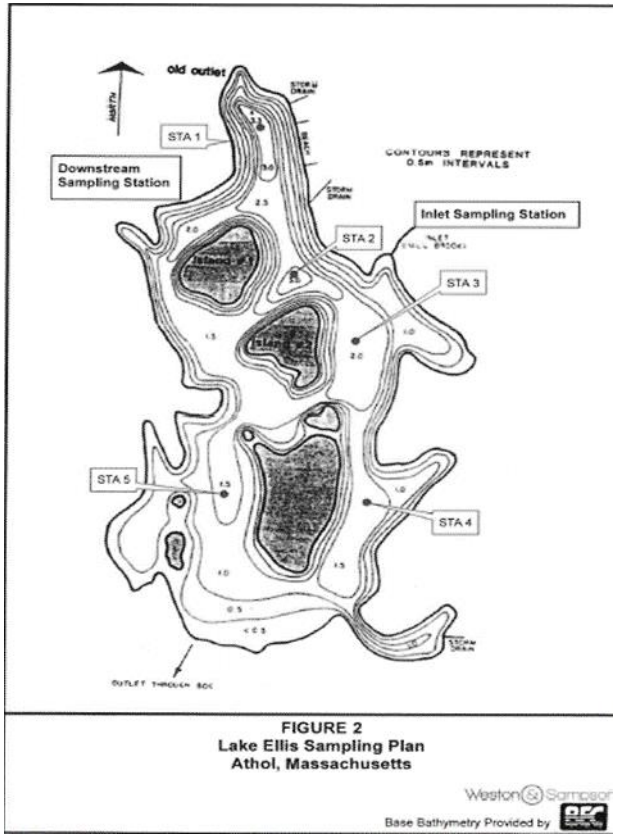
Base Bathymetry Provided by

Station 4 – Depth vs Temperature & DO

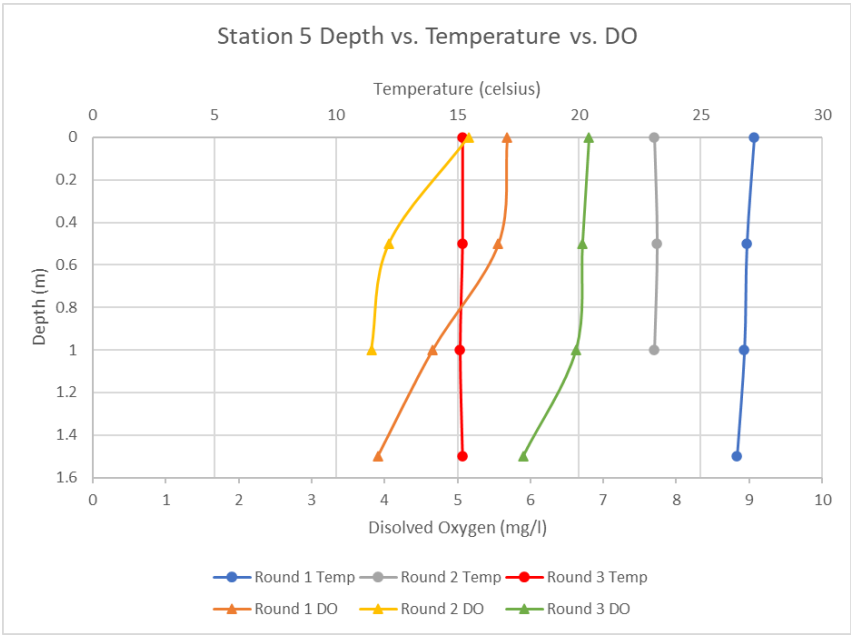


Lake Ellis Watershed Survey
Water Quality Sampling Results

SAMPLING STATION LOCATIONS



Sampling Results
Station 5 – Depth vs Temperature & DO



LAKE ELLIS WATERSHED PROJECT WATER QUALITY DATA SUMMARY

Lake Ellis Sampling - Round 1 - July 21, 2020							
PARAMETER	**STA 1**	**STA 2**	**STA 3**	**STA 4**	**STA 5**	**Mill Brook Upstream Trib**	**Mill Brook Downstream**
Total Suspended Solids (TSS) (mg/L)	3.7	<2.0	2.5	2.5	2.7	<2.0	24
Total Dissolved Solids (TDS)(mg/L)	230	220	220	210	240	230	430
Total Phosporus (TP)(mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06
Orthophosphate (OP)(mg/L	<0.02	<0.02	<0.02	0.04	<0.02	<0.02	<0.02
Chlorophyll a (mg/m3)	0.5	0.5	0.5				
Secchi Depth (m)	2.5	2	1	1	1.5		
Total Coliform	1045.2	1723	409.2	1297.6	2827.2	8164	8164
Fecal Coliform	8	20	<2	2	4	110	356
E. Coli.	12.4	<10	2	<2	8.2	96.2	235.6

LAKE ELLIS WATERSHED SURVEY WATER QUALITY DATA SUMMARY

Lake Ellis Sampling - Round 2 - August 26, 2020							
PARAMETER	**STA 1**	**STA 2**	**STA 3**	**STA 4**	**STA 5**	**Mill Brook Upstream Trib**	**Mill Brook Downstream**
Total Suspended Solids (TSS) (mg/L)	<2.0	<2.0	<2.0	NS	NS	<2.0	<2.0
Total Dissolved Solids (TDS)(mg/L)	240	220	220	NS	NS	350	450
Total Phosporus (TP)(mg/L)	<0.02	<0.02	<0.02	NS	NS	<0.02	0.02
Orthophosphate (OP)(mg/L	<0.02	<0.02	<0.02	NS	NS	<0.02	<0.02
Chlorophyll a (mg/m3)		3					
Secchi Depth (m)	2.25	1.75	1.5	1.25	1.25		
Total Coliform	1297.6	3465.8	>4839.2	NS	NS	4839.2	>4839.2
Fecal Coliform	10	2	<2	NS	NS	406	14
E. Coli.	14.8	8.2	4	NS	NS	27	870.4

LAKE ELLIS WATERSHED SURVEY WATER QUALITY DATA SUMMARY

Lake Ellis Sampling - Round 3 - October 7, 2020							
PARAMETER	**STA 1**	**STA 2**	**STA 3**	**STA 4**	**STA 5**	**Mill Brook Upstream Trib**	**Mill Brook Downstream**
Total Suspended Solids (TSS) (mg/L)	<2.0	<2.0	<2.0	NS	NS	<2.0	<2.0
Total Dissolved Solids (TDS)(mg/L)	220	260	230	NS	NS	350	390
Total Phosporus (TP)(mg/L)	<0.02	<0.02	<0.02	NS	NS	<0.02	<0.02
Orthophosphate (OP)(mg/L	<0.02	<0.02	<0.02	NS	NS	<0.02	<0.02
Chlorophyll a (mg/m3)		1.9					
Secchi Depth (m)	3	2	1.5	1	1		
Total Coliform	307.8	109.2	121.8	NS	NS	957.2	2599.4
Fecal Coliform	8	4	10	NS	NS	28	76
E. Coli.	8.2	<2.0	<2.0	NS	NS	12.6	61

LAKE ELLIS WATERSHED SURVEY WATER QUALITY DATA SUMMARY

MILL BROOK UPSTREAM AND DOWNSTREAM IN SITU RESULTS

Mill Brook Upstream & Downstream			
In Situ WQ Parameter Instrument Results			
Mill Brook - Upstream	Round 1	Round 2	Round 3
Paramete Parameter (Units)			
pH (Std. Units)	6.53	6.78	6.93
Temperature (C)	21.7	17.2	13
Dissolved Oxygen (mg/L)	7.78	6.95	9.53
Specific Conductance (uomos/cm)	0.455	0.443	0.561
Mill Brook - Downstream			
pH (Std. Units)	6.71	6.67	7.12
Temperature (C)	12.9	16.7	13
Dissolved Oxygen (mg/L)	12.68	6.75	7.7
Specific Conductance (uomos/cm)	0.071	0.67	0.653

LAKE ELLIS WATERSHED SURVEY

Next Steps: Consider Improvement Measures:

- Aquatic Weed Control Options:
  - Weed Harvesting
  - Herbicide Applications
  - Lake Level Drawdown
- Watershed Best Management Practices (BMP's)
  - Structural BMP's
  - Non-Structural BMP's
- Restoration of Lake Outlet to Mill Brook
  - Relation to Lake Level Drawdown

LAKE ELLIS WATERSHED SURVEY

WATERSHED BASED MANAGEMENT STRATEGIES

IN-LAKE MEASURES:

STRUCTURAL ALTERNATIVES:

1. **Restore functional outlet to enable seasonal drawdown for weed control, shoreline maintenance, flood control.**

2. **Relocate Northern Drainage into New Outlet**

3. **Install bioremediation swale upgradient from Northern Drainage Outlet.**

LAKE ELLIS WATERSHED SURVEY

WATERSHED BASED MANAGEMENT STRATEGIES

IN-LAKE MEASURES:

WEED CONTROL ALTERNATIVES:

1. Chemical Treatment for Milfoil with ProcellaCOR

2. Incorporate seasonal lake drawdown as soon as possible.

3. Consider chemical application to open water areas to bind sediment phosphorus (e.g., Phosloc or equal).

4. With drawdown in place, perform targeted sediment excavation in near-shore areas to remove decaying weed matter and root stock.

LAKE ELLIS WATERSHED SURVEY

WATERSHED BASED MANAGEMENT STRATEGIES

WATERSHED BASED MEASURES:

Structural Alternatives:

1. Prepare hydrographic survey of Ellinwood Brook to determine elevation and position of "Emergency Lake Outlet"; refine watershed boundary and measure flows discharged from Lake Ellis.

2. Evaluation of Removal of Industrial Era run of the river dams along Mill Brook; including replacement of storage volumes with stormwater vegetated berms, bioretention systems and other elements providing nutrient and solids removal capability.

LAKE ELLIS WATERSHED SURVEY

WATERSHED BASED MANAGEMENT STRATEGIES

WATERSHED BASED MEASURES:

Non-structural Alternatives:

3. Formalize a Lake Ellis Watershed Management Partnership to include representatives of Athol departments (Planning, DPW, Conservation Commission/Agent, Health other as designated by BOS/Town Administrator), Friends of Lake Ellis, Millers River Environmental Center; to share information, review development proposals, conduct education and related public outreach efforts and coordinate funding from a variety of potential funding sources.

4. Conduct a hydrographic and ecosystem survey of the Mill Brook Watershed tributary to Lake Ellis, including mapping of critical areas and buffer zones along Mill Brook and the Lake Ellis shoreline. Incorporate buffer zones as defined in the Wetlands Protection Act and other regulations as a first-cut exercise.

5. Conduct buffer zone surveys and identify areas of buffer zone intrusions and potential pollution sources.

LAKE ELLIS WATERSHED SURVEY

WATERSHED BASED MANAGEMENT STRATEGIES

WATERSHED BASED MEASURES:

Non-structural Alternatives (continued):

6. Develop a Beaver Monitoring Program in the Mill Brook watershed, including the stormwater detention basins associated with the Route 2A shopping plaza.

7. Develop a Stormwater Pollution Prevention Plan for the Elementary/Middle School complex to include sweeping of paved areas; install sediment sacks in catch basin inlets; and evaluate installation of stormwater BMP's (e.g., vegetated berms, bioretention basins) upstream of stormwater discharge outlets.

8. Develop vegetation management plans for both the Elementary/Middle School Complex and the Athol High School athletic fields to include nutrient control limits for both phosphorus and nitrogen sufficient to maintain desired grass cover and limit total annual nutrient loading from athletic fields and facility grounds to protect Lake Ellis from excessive nitrogen and phosphorus inputs.

LAKE ELLIS WATERSHED SURVEY

MANAGEMENT ALTERNATIVES SUMMARY TABLE

MANAGEMENT OPTIONS	PRIORITY	BENEFITS
IN-LAKE MEASURES		
STRUCTURAL ALTERNATIVES:		
1. RESTORE FUNCTIONAL OUTLET	1	Allows seasonal lake level drawdown; adds
2. RELOCATE Northern Drain Outlet	3	Eliminates stormwater discharge directly into Lake Ellis
3. Install bioremediation swale at Northern Drain Outlet	3	Provides in site treatment of nutrient and solids loads
Aquatic Weed Control ALTERNATIVES:		
1. Herbicide Application w/ ProcellaCOR	1	Provides safe long term control of milfoil
2. Begin Seasonal Drawdown ASAP - See Structural Option 1	2	Increases effective duration of herbicide applications and provides opportunities for near shore benthic improvements
3. Limited chemical sequestration of sediment phosphorus - PhosLoc	3	Enhances effectiveness of herbicide application by preventing uptake of sediment phosphorus supporting weed regrowth
4. Targeted Sediment Excavation	2	Eliminates potential regrowth by removal of seed stock in near-shore sediments

LAKE ELLIS WATERSHED SURVEY

MANAGEMENT ALTERNATIVES SUMMARY TABLE

WATERSHED BASED MEASURES		
Structural Alternatives:		
1. Prepare hydrographic survey of Ellinwood Brook swamp to establish elevation and geoposition of "Emergency Lake Outlet"	1	Provides clarity and definition of the boundary delineation for the contributing drainage area of Lake Ellis and aids in the analysis of flood potential
3. Evaluate Removal of abandoned dams remaining in place along Mill Brook upstream from Lake Ellis		Industrial age stone impoundments are in very poor structural condition; removal may enhance ecosystem stabilization and help to control flooding volumes and stream velocities during high flow events
Non-structural Alternatives:		
3. Formalize a Lake Ellis Watershed Management Partnership	1	Formalizing a lake management partnership will keep the public aware of activities, costs, implementation schedules and results. Mill Brook is the largest single tributary to Lake Ellis and is burdened by a variety of land uses, nutrient sources and wildlife habitat issues.
4. Conduct a hydrographic and ecosystem survey of the Mill Brook subwatershed tributary to Lake Ellis, including mapping of buffer zones and resource areas	1	A complete hydrographic survey will provide critical baseline mapping and slope analysis for use in evaluating flood impacts, changes in stream conditions and habitat within this subwateshed and potential locations for pollution control and remediation strategies.
5. Conduct buffer zone surveys and identify areas of intrusions and potential pollution sources	3	Included in Alternative 4.
7. Implement a Beaver Monitoring Program along Mill Brook		Included in Alternative 4.

LAKE ELLIS WATERSHED SURVEY

MANAGEMENT ALTERNATIVES SUMMARY TABLE

- 8. Develop Stormwater Pollution Prevention Plan for Elementary/Middle School Complex

- 9. Develop vegetation management plans for Elementary/Middle School Complex and Athol High School Athletic Fields

LAKE ELLIS WATERSHED SURVEY PUBLIC INVOLVEMENT PROGRAM

- WE WANT TO HEAR FROM YOU!
  - WHAT'S IMPORTANT TO YOU?
  - HAVE WE CAPTURED THE MOST CRITICAL ISSUES FACING LAKE ELLIS?
  - HOW CAN YOU CONTACT THE PROJECT TEAM?

Joe McGinn, Weston & Sampson, mcginnj@wseinc.com

Katherine Robertson, Robertson Associates, krobertsconsulting@hotmail.com

Eric Smith, Athol Planning & Community Development, planning@townofathol.org

LAKE ELLIS WATERSHED SURVEY

Questions?

Comments?

Thank you for your participation!

thank you

westonandsampson.com

transform your environment